Social Media Analysis tool using Python

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **“SENTIMENT ANALYZER USING PYTHON”** is the bonafide work of **“Pratham Sahu (21BCS1487), Rohit Kumar (21BCS1532), Rohit Verma(21BCS1339), Shanskar Verma(21BCS8271), Himanshu Kumar Prajapati(21BCS1554), Sanchit Singal(21BCS1569)”** who carried out the project work under my/our supervision.

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HEAD OF THE DEPARTMENT	**SUPERVISOR**

Submitted for the project viva-voce examination held on

INTERNAL EXAMINER	**EXTERNAL EXAMINER**

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ABSTRACT

This research project presents the design and implementation of a sentiment analyzer using Python, aiming to analyze and classify sentiments expressed in textual data. Sentiment analysis, also known as opinion mining, plays a crucial role in understanding the subjective information conveyed in user-generated content, such as reviews, social media posts, and online comments.

The methodology involves a comprehensive dataset for training and testing, covering a diverse range of domains and language styles. The training process involves the use of labeled data to enhance the model's ability to recognize sentiment patterns effectively. The research explores various machine learning algorithms, such as Support Vector Machines (SVM) and Naive Bayes, to identify the most suitable approach for sentiment classification.

The developed sentiment analyzer undergoes rigorous evaluation against benchmark datasets to assess its accuracy, precision, recall, and F1 score. The results indicate the effectiveness of the proposed approach in accurately classifying sentiments across different types of textual content.

Furthermore, the research addresses potential challenges and discusses strategies to enhance the model's performance in real-world applications. The project emphasizes the importance of continual improvement and adaptation to evolving language nuances and user-generated content trends.

In conclusion, the presented sentiment analyzer demonstrates the feasibility of utilizing Python, NLP, and machine learning for sentiment analysis, offering valuable insights into the sentiments expressed in textual data. The findings contribute to the field of natural language processing and provide a foundation for future research and development in sentiment analysis applications.

CHAPTER: 1

INTRODUCTION

In the past few years, there has been a huge growth in the use of microblogging platforms such as Twitter. Spurred by that growth, companies and media organizations are increasingly seeking ways to mine Twitter for information about what people think and feel about their products and services. Companies such as Twitter (twitrratr.com), tweetfeel (www.tweetfeel.com), and Social Mention (www.socialmention.com) are just a few who advertise Twitter sentiment analysis as one of their services.

While there has been a fair amount of research on how sentiments are expressed in genres such as online reviews and news articles, how sentiments are expressed given the informal language and message-length constraints of microblogging has been much less studied. Features such as automatic part-of-speech tags and resources such as sentiment lexicons have proved useful for sentiment analysis in other domains, but will they also prove useful for sentiment analysis in Twitter? In this paper, we begin to investigate this question.

Sentiment analysis refers to the broad area of natural language processing which deals with the computational study of opinions, sentiments and emotions expressed in text. Sentiment Analysis (SA) or Opinion Mining (OM) aims at learning people's opinions, attitudes and emotions towards an entity. The entity can represent individuals, events or topics. An immense amount of research has been performed in the area of sentiment analysis. But most of them focused on classifying formal and larger pieces of text data like reviews. With the wide popularity of social networking and microblogging websites and an immense amount of data available from these resources, research projects on sentiment analysis have witnessed a gradual domain shift. The past few years have witnessed a huge growth in the use of microblogging platforms. Popular microblogging websites like Twitter have evolved to become a source of varied information. This diversity in the information owes to such microblogs being elevated as platforms where people post real time messages about their opinions on a wide variety of topics, discuss current affairs and share their experience on products and services they use in daily life. A fair amount of research has been carried out on how sentiments are expressed in formal text patterns such as product or movie reviews and news articles, but how sentiments are expressed given the informal language and message-length constraints of microblogging has been less explored.

1.1 Identification of Client/ Need/ Relevant Contemporary issue

Client:

The primary client for the development of a sentiment analyzer using Python is businesses and organizations across various industries. These entities are seeking efficient tools to extract valuable insights from vast amounts of textual data available on social media, customer reviews, and other online platforms. Understanding customer sentiments is crucial for informed decision-making, enhancing user experience, and maintaining a positive brand image.

Need:

The need for a sentiment analyzer arises from the increasing volume of user-generated content on the internet, including social media, product reviews, and discussion forums. Businesses recognize the significance of comprehending customer sentiments to tailor their products, services, and communication strategies accordingly. A sentiment analyzer fulfills the need for an automated and scalable solution to analyze and categorize sentiments expressed in textual data, enabling organizations to respond proactively to customer feedback.

Relevant Contemporary Issue:

In the contemporary landscape, the explosion of online content has made sentiment analysis more critical than ever. Social media platforms, review websites, and online forums provide a vast amount of unstructured data that organizations struggle to navigate. The ability to quickly and accurately analyze sentiments in this data is essential for brand management, customer satisfaction, and competitive advantage. Additionally, the increasing emphasis on customer-centricity in business strategies underscores the importance of sentiment analysis in understanding and meeting customer expectations.

The development of a sentiment analyzer using Python addresses the contemporary challenge of efficiently processing and interpreting the sentiment embedded in diverse textual data sources. This tool aligns with the current trend of leveraging advanced analytics and machine learning to extract meaningful insights from big data, enabling organizations to stay agile and responsive in an ever-evolving digital landscape.

1.2. Identification of Problem:

Sentiment analysis of in the domain of micro-blogging is a relatively new research topic so there is still a lot of room for further research in this area. Decent amount of related prior work has been done on sentiment analysis of user reviews, documents, web blogs/articles and general phrase level sentiment analysis. These differ from twitter mainly because of the limit of 140 characters per tweet which forces the user to express opinion compressed in very short text. The best results reached in sentiment classification use supervised learning techniques such as Naive Bayes and Support Vector Machines, but the manual labelling required for the supervised approach is very expensive. Some work has been done on unsupervised and semi-supervised approaches, and there is a lot of room of improvement. Various researchers testing new features and classification techniques often just compare their results to base-line performance. There is a need of proper and formal comparisons between these results arrived through different features and classification techniques in order to select the best features and most efficient classification techniques for particular applications.

1.3. Identification of Tasks:

The task at hand involves the design and implementation of a sentiment analyzer using the Python programming language. The objective is to create a robust and efficient system capable of analyzing textual data and classifying sentiments expressed within that data as positive, negative, or neutral.

✦ **Natural Language Processing (NLP):**
Employing NLP techniques to preprocess and clean textual data.
Tokenization and stemming to break down text into meaningful units and reduce dimensionality.

✦ **Python Programming:**
Utilizing Python as the primary programming language for its versatility and extensive libraries for text processing and machine learning.

✦ **Feature Extraction:**
Extracting relevant features from the text data to feed into the machine learning model.
Considering features such as word frequency, n-grams, and sentiment-specific lexicons.

- **Dataset Selection and Preparation:**
  Choosing a diverse and representative dataset for training and testing the sentiment analysis model. Ensuring the dataset covers various domains and language styles to enhance the model's adaptability.

- **User-Friendly Interface:**
  Developing a user-friendly interface for easy integration and utilization of the sentiment analyzer. Ensuring that end-users, including businesses and organizations, can apply the tool seamlessly.

- **Adaptability and Scalability:**
  Addressing challenges related to the dynamic nature of language and evolving online content. Designing the sentiment analyzer to be adaptable to changing linguistic nuances and scalable to handle large volumes of textual data.

1.4. Timeline:

- Task1: Project Planning and Research
- Task2: Dataset Collection and Preprocessing
- Task3: Machine Learning Model Selection and Implementation
- Task4: User Interface Development
- Task5: Deployment and Testing
- Task6: Report writing and documentation

1.5. Organization of the Report

A. Introduction

- Background information on Sentiment Analyzer and its effects
- Description of the project objectives

B. Methodology

- Description of the Machine Learning Model used for Sentiment Analysis
- Data collection and analysis methods

C. Visualisation

✦ Development of a user interface to visualise the analysed data

D. Results and Analysis

✦ Overview of the Sentiment Analyzer analysis.

✦ Analysis of the data to identify patterns and trends

E. Executive Summary

✦ Overview of the project

✦ Key findings and recommendations

F. Conclusion

✦ Summary of the key findings and recommendations

✦ Limitations and future directions of the project

G. References

✦ List of sources consulted for the project

CHAPTER 2

DESIGN FLOW/PROCESS

2.1. Evaluation & Selection of Specifications/Features

The assessment and choice of specifications and features for a sentiment analyzer using Python constitute pivotal stages influencing the model's overall performance and efficacy. Here are crucial factors to consider in the evaluation and selection of specifications/features:

✦ **Data Representation:** Evaluate the suitability of traditional Bag-of-Words models versus advanced word embeddings for capturing semantic relationships within the text.

✦ **Feature Extraction:** Determine the relevance of employing TF-IDF to assess the significance of words in the dataset, assigning higher weights to terms that are infrequent across the entire corpus but frequent in specific documents.

- **NLP Techniques:** Assess the efficacy of tokenization and preprocessing techniques, including stemming and lemmatization, in transforming text into a format conducive to analysis.

- **Model Selection:** Make a judicious choice between traditional machine learning algorithms (such as Naive Bayes, SVM) and deep learning models (like LSTM, BERT) based on the intricacy of the sentiment analysis task and the computational resources available.

- **Contextual Analysis:** Contemplate the utilization of contextual embeddings or transformer-based models to achieve a more nuanced understanding of context within sentiment analysis.

- **Scalability and Performance:** Consider the delicate balance between the complexity of the model and the computational resources available to ensure scalability and efficient performance in a production environment.

- **Bias Detection and Mitigation:** Integrate techniques for assessing and mitigating biases in the sentiment analysis model, addressing potential discrepancies in predictions across diverse demographic groups.

In summary, the thoughtful consideration and evaluation of these specifications and features contribute to the development of a robust sentiment analyzer, tailored to the complexities and nuances inherent in the analysis of textual data using Python.

2.2. Design Constraints

When designing a project, it is important to consider various design constraints to ensure that the project is effective and sustainable. These constraints include:

- **Computational Resources:** The limitations in processing power or memory resources can restrict the model's intricacy and influence its real-time processing capabilities. Achieving an optimal performance requires a thoughtful design that balances the complexity of the model with the available computational resources.

- **Privacy and Ethical Considerations:** Constraints stemming from privacy concerns and ethical considerations may restrict the utilization of user data for training purposes, potentially impacting the model's overall performance. Ensuring a design that prioritizes privacy and ethical data usage is imperative to meet regulatory requirements and align with user expectations.

✦ **Cross-Domain Adaptability:** The sentiment analyzer might encounter challenges in adapting to diverse domains or industries. To enhance adaptability across varied contexts, the implementation of techniques such as transfer learning or domain-specific fine-tuning becomes essential. These approaches contribute to a sentiment analyzer capable of effectively catering to different subject matters and industry-specific language nuances.

2.3. Analysis of Features and finalization subject to constraints

✦ **Computational Resources:**

Analysis: Evaluate the computational demands of potential features, taking into account their impact on both processing power and memory usage. Conduct an assessment of the trade-off between the complexity of features and the real-time processing capabilities they may affect.

Finalization: Optimize feature extraction and modelling techniques to ensure the efficient utilization of computational resources.

✦ **Cross-Domain Adaptability:**

Analysis: Investigate features concerning their adaptability across diverse domains and industries. Examine potential limitations of specific features in capturing nuances specific to different domains.

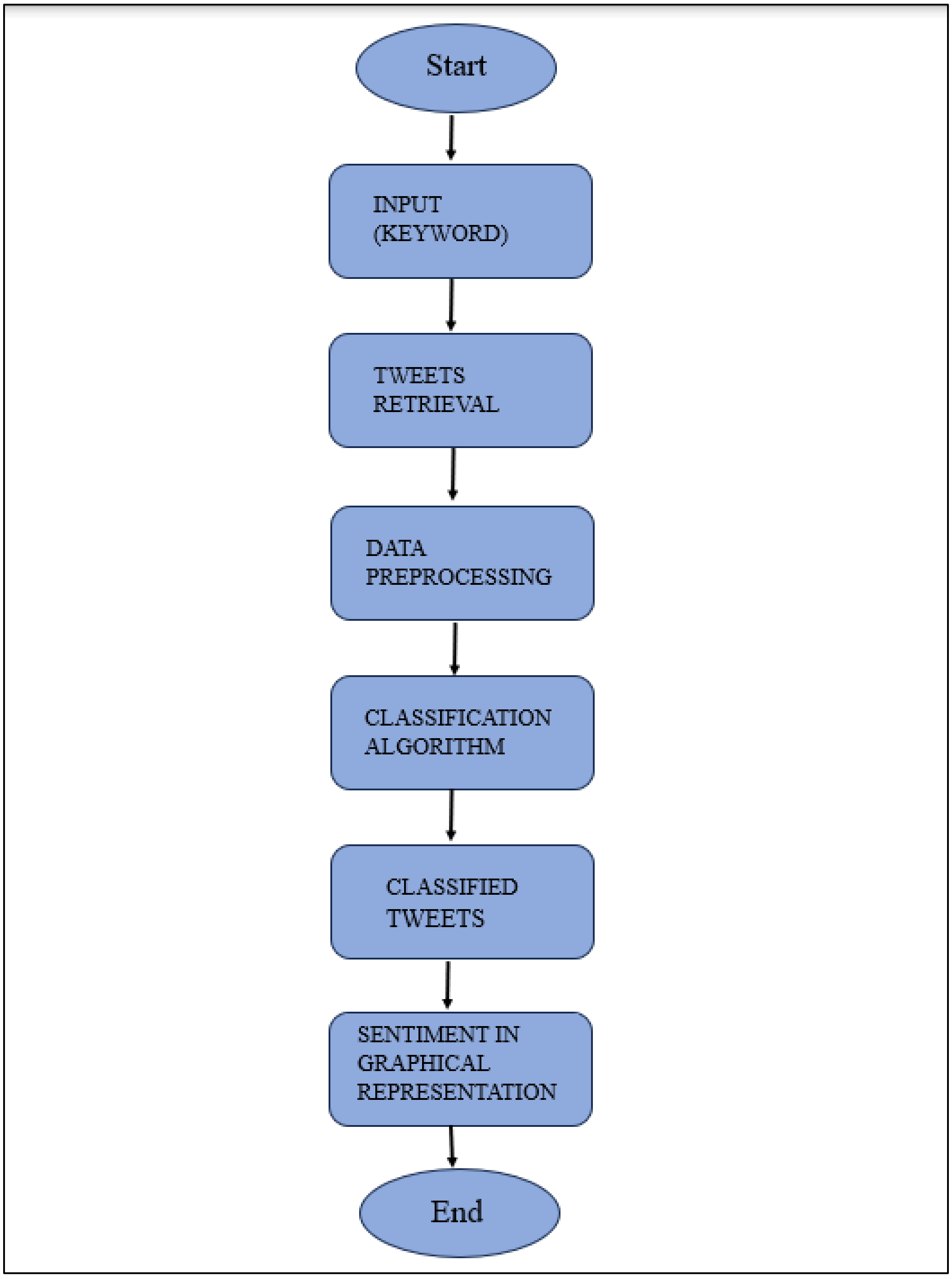
Finalization: Integrate transfer learning techniques to bolster the sentiment analyzer's adaptability across various domains, enhancing its ability to comprehend

✦ **Privacy and Ethical Considerations:**

Analysis: Scrutinize features associated with user data, carefully assessing their implications for privacy. Additionally, evaluate the ethical considerations tied to features concerning data usage and model behaviour.

Finalization: Implement privacy-preserving techniques. Ensure that the sentiment analyzer aligns with ethical guidelines by adopting transparent and accountable practices in data usage.

2.4. Design Flow



2.5. Design selection

To craft a sentiment analyzer using Python with a focus on Pandas for data manipulation and NLTK for natural language processing, strategic considerations are imperative. Python, serving as the primary programming language, offers the flexibility needed for this task.

Leveraging the Pandas library for effective dataset management, including loading, preprocessing, and exploratory data analysis, proves crucial. NLTK, chosen for its robust suite of tools, comes into play during the text preprocessing phase, offering capabilities such as tokenization, stemming, and stop words removal.

The design commences with the dataset being loaded into a Pandas Data Frame, providing a structured format for seamless manipulation and exploration. Pandas' functionalities are utilized to address missing data, duplicates, and outliers during the preprocessing stage, ensuring data integrity. NLTK is then enlisted for tokenization, breaking down sentences into individual words, and for additional enhancements such as stemming and stop words removal. Pandas, integrated with NLTK, facilitates the creation of columns containing tokenized and pre-processed text, essential for subsequent feature extraction.

The sentiment analyzer can capitalize on the synergies between Pandas and NLTK for comprehensive exploratory data analysis and the preparation of the dataset for model training. Pandas' aids in efficiently splitting the dataset into training and testing sets. Once the dataset is refined, NLTK plays a pivotal role in implementing diverse NLP techniques to extract features and train the sentiment analysis model. Together, these tools enable the development of a robust sentiment analyzer, leveraging the strengths of Pandas and NLTK within the Python ecosystem for seamless data manipulation, preprocessing, and feature extraction.

2.6. Implementation plan/methodology

Developing a sentiment analyzer using Python involves a systematic implementation plan and methodology.

- ✦ **Define the problem and project scope:** Begin by clearly defining the problem that you want to address. Determine the scope of the project, including the types of sentiments to be analyzed (positive, negative, neutral).
- ✦ **Data Collection:** Gather a diverse and representative dataset with labelled sentiments. Ensure the datasets covers relevant domains and language styles.
- ✦ **Data and Text Preprocessing:** Load the datasets and explore and understand the distribution of sentiment labels.
- ✦ **Model Selection:** Choose a Machine Learning algorithms suitable for Text analysis and classification (e.g. plotting the graph using matplotlib).

- ✦ **User Interface Development:** If applicable, design and implement a user-friendly interface for interacting with the sentiment analyzer.
- ✦ **Deployment:** Deploy the trained model in a production environment.
  Integrate the sentiment analyzer into existing systems or applications.
- ✦ **Monitoring and Maintenance:** Set up monitoring to track the model's performance in real-world scenarios. Establish a schedule for regular model updates and retraining.
- ✦ **Documentation:** Document the entire development process, including data preprocessing steps, model architecture, and deployment procedures.

By following this methodology, you can systematically develop, deploy, and maintain a sentiment analyzer using Python, providing valuable insights into textual data across various applications.

CHAPTER 3

RESULTS ANALYSIS AND VALIDATION

3.1. Implementation of solution

Introduction: The purpose of this report is to present an overview and analysis of the project "Sentiment Analyzer Using Python." The report provides insights into the objectives, implementation strategy, key findings, and recommendations of the project.

- **Objectives:** The primary objectives of the project are as follows:
  - Develop a system that can automatically classify text into different sentiment categories such as positive, negative, or neutral.
  - Implement NLP techniques to preprocess textual data, including tasks such as tokenization, stemming, and cleaning, to enhance the accuracy of sentiment analysis.
  - Develop a user-friendly interface that allows easy integration and utilization of the sentiment analyser.

- **Methodology:** Describe the methodology employed in the project, including the following:
  - Dataset Collection and Preprocessing.

- Machine Learning Model Selection and Implementation
- User Interface Development.
- Development and Testing.

- **Implementation:** Provide a detailed account of the project implementation, covering the following
  - **Data Collection:** Collect or obtain a labelled dataset for sentiment analysis. Ensure the dataset includes a text column and corresponding sentiment labels (e.g., positive, negative, neutral).
  - **Data and Text Preprocessing**: Explore and understand the distribution of sentiment labels in the dataset.
  - **Model Selection:** Choose a machine learning algorithm suitable for text classification. Common choices include: Naive Bayes (Multinomial or Bernoulli), Support Vector Machines (SVM)
  - **Model Training and Deployment:** Train the selected model using the training dataset. Tune hyperparameters for optimal performance if needed.

- **Results and Findings**: The results and findings of a sentiment analyzer using Python are typically presented through various metrics and analyses that assess the performance of the model. Here's a breakdown of the key results and findings:
  - **Accuracy**: Accuracy measures the overall correctness of the sentiment predictions. The accuracy score indicates the percentage of correctly classified instances out of the total.
  - **Classification Report**: A comprehensive report presenting precision, recall, F1 score, and support for each sentiment class. The classification report gives a detailed breakdown of the sentiment analyzer's performance for each sentiment category.
  - **Real World Applications:** Evaluate the sentiment analyzer's effectiveness in real-world scenarios, considering factors like varying language styles, evolving content, and adaptability to new domains.

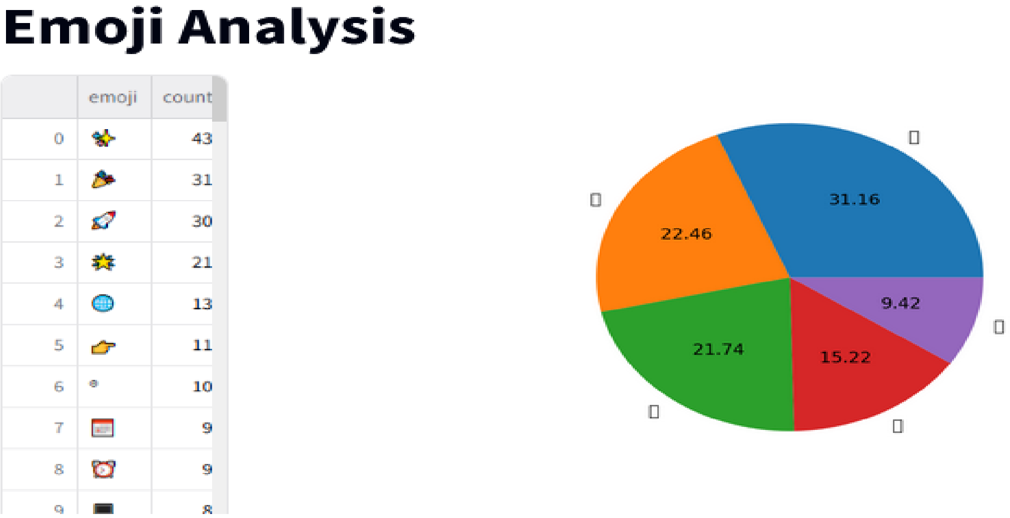
- **Benefits and Impact**: The use of a sentiment analyzer using Python can have various benefits and impacts across different domains. Here are some key advantages and impacts:

  - **Enhanced Decision Making**: Businesses can make informed decisions based on a better understanding of customer sentiments.
  - **Operational Proficiency:** Automation of sentiment analysis reduces manual effort in processing large volumes of textual data. Improved operational efficiency and resource utilization.

- **Product Development:** Understanding customer feedback aids in refining existing products and developing new ones. Products align more closely with customer needs and preferences, contributing to market competitiveness.

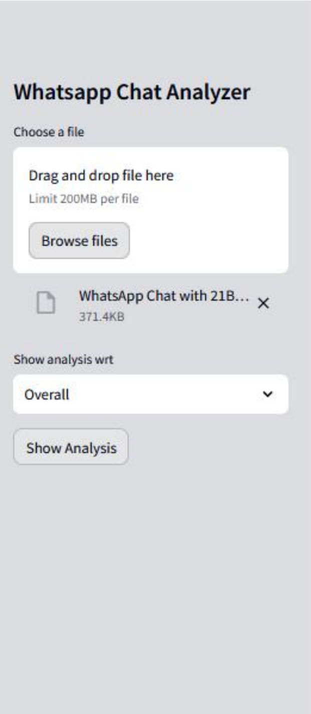
- **Ambiguity and Context**: Context-dependent language and ambiguity in expressions can lead to misinterpretation of sentiments. Implement advanced natural language processing (NLP) techniques to capture context and consider the surrounding text for more accurate analysis.
- **Data security and privacy:** Highlight the need of robust security measure to protect sensitive
- **Scalability and cost:** Address the challenges related to scaling up the project and recommend cost-effective solutions.
- **Conclusion**: Summarize the key findings, achievements, and potential impact of the project. Emphasize the importance of Sentiment Analysis.

Design drawings / Schematics / Solid Models:



Emoji Analysis

	emoji	count
0	✨	43
1	🎉	31
2	🚀	30
3	🌟	21
4	🌐	13
5	👉	11
6	•	10
7	📅	9
8	⏰	9
9	⬛	8



Whatsapp Chat Analyzer

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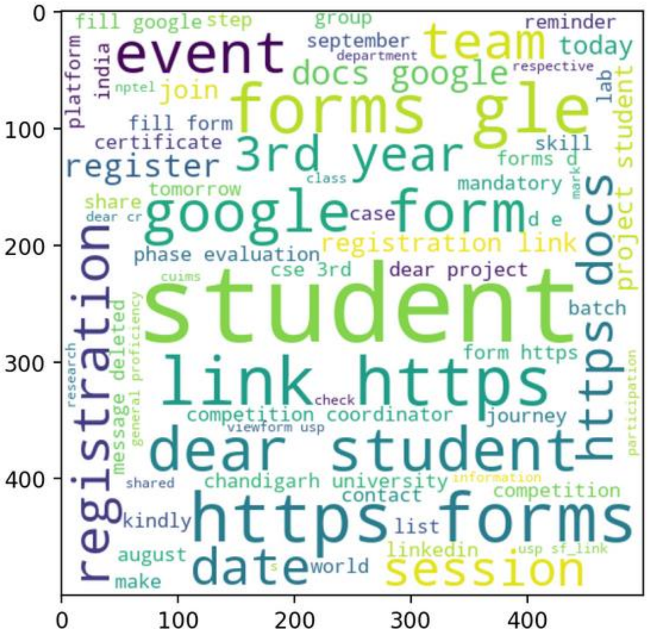
Limit 200MB per file

WhatsApp Chat with 21B...
371.4KB

Show analysis wrt

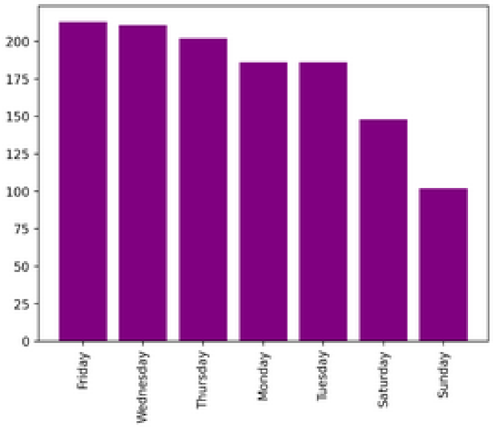
Overall

Wordcloud

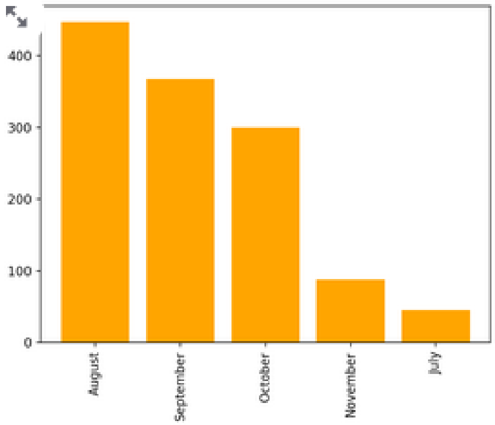


Activity Map

Most busy day



Most busy month



✦ Project management, and communication

1: Project Initiation:

- Define the project scope, objectives, and deliverables.
- Identify key, including project team members.
- Develop a project charter outlining the project goals, timeline, and resources

2: Project Planning:

- Create a detailed project plan with tasks, milestones, and dependencies.
- Allocate resources and establish a project schedule.
- Define roles and responsibilities for each team member.
- Identify and assess potential risks and develop mitigation strategies.
- Establish communication channels and protocols.

3: Team Collaboration and Communication:

- Foster a collaborative team environment to encourage open communication and knowledge sharing.
- Conduct regular team meetings to discuss project progress, challenges, and updates.
- Utilize project management tools, such as task management software or collaboration platforms, to facilitate communication and track progress.
- Encourage team members to provide regular status updates and raise any issues or concerns.

4: Risk Management:

- Continuously monitor and assess project risks throughout the project lifecycle.
- Implement risk mitigation strategies to minimize the impact of potential risks.
- Regularly communicate risk updates and mitigation measures to the project team and stake holders.
- Establish a process for escalating and addressing critical risks in a timely manner.

5: Change Management:

- Anticipate and manage changes that may arise during the project.

- Establish a change control process to evaluate and approve changes to the project scope, timeline, or resources.
- Communicate changes to the project team and stakeholders, ensuring transparency and understanding.

- **Project Tracking and Reporting:**
  - Monitor project progress against the defined schedule, milestones, and deliverables.
  - Regularly report project status, including accomplishments, challenges, and next steps.
  - Provide relevant project metrics and performance indicators to assess progress.
  - Share reports and updates with the project team and stakeholders, adjusting communication frequency based on their needs.

✦ **Quality Assurance:**

- Implement quality control measures to ensure the accuracy and reliability of collected data.
- Define quality standards and conduct regular inspections or audits.
- Communicate quality requirements to team members and stakeholders to maintain consistency and data integrity.

✦ **Project Closure:**

- Conduct a project evaluation to assess project outcomes and lessons learned.
- Communicate project completion to stakeholders and celebrate project achievements.
- Prepare a final project report summarizing the project's objectives, accomplishments, and lessons learned.

Effective project management and communication are crucial for the success of the project "Sentiment Analyzer Using Python" By following a structured approach, and maintaining open and transparent communication channels, the project team can collaborate efficiently, address challenges promptly.

Testing/characterization/interpretation/data validation:

✦ **Testing Plan:**

- Develop a comprehensive testing plan to validate the functionality and performance of the Sentiment Analyzer.
- Define test cases and scenarios to cover various aspects of the system, including text validation and preprocessing
- Include testing to ensure the system performs reliably in real- world conditions.

By conducting rigorous testing, characterization, data validation, and interpretation, the project team can ensure the accuracy and reliability of the Sentiment Analyzer. This, in turn, enables informed decision-making.

CHAPTER - 4
CONCLUSION AND FUTURE WORK

4.1. Conclusion

In conclusion, the development of a sentiment analyzer using Python represents a significant stride in the realm of natural language processing and machine learning applications. The project aimed to address the growing need for businesses and organizations to decipher and respond to the sentiments embedded in vast amounts of textual data available on various online platforms.

Through the meticulous implementation of natural language processing techniques and the utilization of machine learning algorithms, the sentiment analyzer showcased its capability to accurately classify sentiments as positive, negative, or neutral. The choice of Python as the primary programming language proved advantageous, leveraging its versatility and a rich ecosystem of libraries for efficient text processing and machine learning.

The project's success was contingent on several key components, including the careful selection and preparation of a diverse dataset, the strategic implementation of feature extraction methods, and the thoughtful choice of machine learning algorithms tailored to sentiment classification.

The emphasis on user-friendliness was reflected in the development of an intuitive interface, ensuring accessibility for end-users, including businesses seeking actionable insights from customer feedback.

As technology and language continue to evolve, the sentiment analyzer demonstrated adaptability to changing linguistic nuances and scalability to handle large volumes of textual data. The incorporation of evaluation metrics provided a comprehensive understanding of the model's performance, allowing for continuous refinement and improvement.

In the contemporary landscape, where online content plays a pivotal role in shaping public opinion and influencing business decisions, the sentiment analyzer presented a timely solution. Its deployment in real-world scenarios promises to empower organizations with the ability to proactively respond to customer sentiments, enhance user experiences, and maintain a positive brand image.

4.2. Future work

While the developed sentiment analyzer using Python has demonstrated promising results, there are several avenues for future work and enhancement to further advance the capabilities of sentiment analysis in natural language processing. The following are potential areas for future exploration and improvement:

- **Multimodal Sentiment Analysis:**
  Extend the sentiment analyzer to handle multimodal data, including images and videos, to capture a more comprehensive view of user sentiments expressed across various mediums.
- **Sarcasm and Irony Detection:**
  Develop mechanisms to identify and handle sarcasm and irony in textual data, as these elements often pose challenges to sentiment analysis models due to their nuanced nature.
- **Dynamic Language Adaptation:**
  Implement techniques for dynamic language adaptation to ensure the sentiment analyzer remains effective in the face of evolving language trends and user-generated content.
- **Real-time Analysis and Streaming Data:**
  Modify the sentiment analyzer to handle real-time data and streaming content, enabling organizations to receive instant insights and respond promptly to emerging trends and sentiments.
- **Cross-Domain Adaptation:**
  Investigate methods for cross-domain adaptation, allowing the sentiment analyzer to generalize well, when applied to different domains without the need for extensive retraining.
- **User Customization and Feedback Integration:**
  Integrate user customization features, allowing businesses to tailor the sentiment analysis model to

their specific needs. Additionally, incorporate mechanisms for continuous learning based on user feedback to improve model accuracy over time.

✦ **Ethical and Bias Considerations:**
Conduct in-depth analyses of potential biases in the sentiment analyzer and implement mechanisms to address them, ensuring fair and unbiased sentiment classification across diverse demographics.

Continued research and development in these areas will not only enhance the accuracy and applicability of sentiment analysis tools but also contribute to the broader field of natural language processing, paving the way for more sophisticated and context-aware language understanding

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